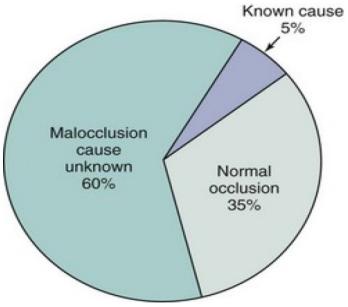
An Analysis of The Potential Causes and Treatments of Malocclusion

Hello there. This is an evidence summary / critical review I've been working on for a few years now, on the potential causes and treatments of malocclusion. It has been written with the guidance and suppourt of countless individuals, all of which I am incredibly thankful for.

If you're reading this, chances are it is because I asked you to. I just wanted to firstly say thanks to you! And I hope you find this informative, or at the very least an engaging read. I must warn you, however, that this is still in its early stages, and so the work is largely conversational while I try and piece the evidence together. I also want to state that I am one admittedly very biased layman, not a dentist or orthodontist. My background is in nutrition and dietetics, which I am currently studying a Masters in. Because of this, I doubt I will have the level of understanding and comprehension to truly make a professional thesis on the subject - but health is my passion, and I wanted to give this an honest shot, in the hope that it might be of some good use to someone. It is because of this passion that I am so determined to seek the guidance of professionals from various fields of health and history. Anyway, If you would like to discuss these ideas with me, please feel free to contact me at /u/josephgreg on reddit. I wanted to begin by defining the issue.



"From a broad perspective, only about one-third of the U.S. population has normal occlusion, while two thirds have some degree of malocclusion. In the malocclusion group, only a small minority (not more than 5%) have problems attributable to a specific known cause; the remainder are the result of a complex and poorly understood combination of inherited and environmental influences." **Proffit, Fields & Sarver. 2006.**

In other words, it's multifactorial, and these factors are not well understood. This well known book, "Contemporary Orthodontics", the leading text in orthodontic education, was published in 2006. And yet, over ten years on, we don't seem to have learned much more. Malocclusion, which refers to crookedness of the teeth and jaws, still appears to be little understood, and there doesn't seem to be a significant push by orthodontic bodies into conducting research to identify its potential root cause(s). In the world of health, where new data and mechanisms are constantly appearing in order to deepen understanding of everything from heart disease, cancer, and mental illness, the aetiology of malocclusion remains an inexplicably neglected anomaly.

While some could certainly argue that the incentive of providing a costly treatment to a significant chunk of the population may be a factor in this lack of interest (In many areas of health, prevention is often much cheaper than treatment), I believe that the vast majority of orthodontic professionals care deeply about their patients. I don't think that they are actively trying to hide information, or exploit them, which can be a common sentiment whenever the aetiology of diseases is discussed. I think we may just be so acclimatised to the fact that most of us are affected by these issues, so much so that we fail to notice or question them. Ultimately, however, 60% of us experience a poorly understood condition which can be uncomfortable, painful, and potentially detrimental to physical and mental wellbeing. And if only 5% of total malocclusion cases can be linked to conditions such as dental diseases, syndromes and physical traumas, resulting in malocclusion or hindering jaw growth, what could the remaining factors responsible for the other 60% be? I think this is a fascinating question, one that could potentially improve the lives of literally billions of people. It deserves our curiosity.

a b c

While there are countless schools of thought, there are two interesting hypotheses I wanted to draw attention to. The first hypothesis is that malocclusion is caused by some kind of genetic issue(s). The second is that it is a result of deficiency in one or more nutrients. Let's first explore the former.

According to the Australian Society of Orthodontists, "when extra teeth or abnormally large teeth create a malocclusion...the culprit is usually genetic in nature. Other inherited traits involve jaws that are too small to accommodate a full set of teeth and misaligned jaws that did not form properly. In most cases, underbites, overbites, or crooked teeth are genetic and can't be avoided. Orthodontic treatment with braces will be necessary to correct the condition once your child is old enough to wear them." ASO, 2019.

It is also acknowledged that malocclusion can contribute to a range of health problems, including wear and tear, gum disease and injury, as well as tooth decay. **Betterhealthvic, 2019.**

Beyond standard crooked teeth, wisdom tooth impaction is another highly frequent issue, affecting 72% of the population in the mandible (lower jaw) alone. **Dodson et al. 2010** highlighted that impacted wisdom teeth "can cause inflammatory dental disease manifested by pain and swelling of infected

teeth and may destroy adjacent teeth and bone." Only 11.6-37% of retained wisdom teeth are free of disease and other symptoms. **Dodson et al., 2010 & 2012**. Given the high rate of wisdom teeth impaction, as well as the frequency of potentially severe side effects, this begs the question as to why this is such an issue in the first place. Yes, wisdom teeth impaction, by its definition, is when there is not enough space in the jaws to house all 32 teeth, but why is this the case? If this is a genetic issue that has existed for many years, why does it exist in such high frequencies today, seemingly unaffected by natural selection? If anything, it certainly calls into question the "wisdom" of such an evolutionary path.


(Courtesy M.J. Barrett.)

Next, I think we should also take into consideration the importance of properly functioning jaws to our survival. This might sound surprising, as today, even severe malocclusions may not have a huge impact on our ability to eat a diet that is very soft and calorically dense (think mashed potatoes, white pasta, liquid calories, etc.).

However, history provides a different, but fascinating story. Our ancestors, for milenna, subsisted on uncooked or partially cooked animal and plant foods, which were mostly calorically dilute. Notice the image on the left (from **Proffit, Fields & Sarver. 2006)**, of an Indigenous Australian man eating a piece of kangaroo with bare hands. We can see from the striations present that he is using significant amounts of upper body (and presumably jaw) strength for this meal. To survive on this kind of diet (knife, fork and blender not included), properly functioning jaws and teeth would be essential, as its toughness and low calorie nature would require a significant amount of tough chewing. It isn't hard to imagine how, say, a substantial underbite, or teeth that don't meet together correctly, would, to put it bluntly, be a death sentence.

Finally, given that malocclusion is also typically seen as less attractive, we would expect sex selection to play a role here as well (**Pithon** et al. 2016). And yet, despite all of these factors, which, presumably, would encourage malocclusion to occur at low frequencies, we are currently faced with something of a pandemic that affects most of the populace. For these reasons, and more, I'm just not convinced that genetics is the primary factor that it's made out to be.

For my next point, observe the faces below.



There are 5,146 species of mammal (I included the shark because of its impressive set of chompers). However, as we can see, they don't seem to be struggling with severe malocclusions. When was the last time you saw a tiger with an underbite, for example, or a chimpanzee that required up to 8 teeth extractions, due to small jaws? Is it just our genes which are defective? I'm skeptical about this.

Perhaps by examining the occlusion of other primates, who are closest interspecies relatives, we may be able to get a slightly better understanding of the role, or lack thereof, of our genes.

TABLE I

POSITION VARIATIONS IN THE DIFFERENT ORDERS (AFTER COLYER)

Orders	No. of specimens	No. varying	Percentage of specimens varying
Primates	8148	2224	27·3
Carnivora	4419	284	6·4
Rodentia	1819	12	0·7
Ungulata	1335	162	12·1
Hyracoidea	300	37	12·3
Marsupialia	2344	75	3·2

Research by the dental historian Colyer, presented in the work of Mills (1963) indicates that overall, the rate of malocclusion across mammals is substantially lower than modern norms in humans. However, while the existence of malocclusion in other primates is still substantially lower than our own, at 27.3%, it still is something of an anomaly here. Let's take a closer look.

TABLE II

INCIDENCE OF MALOCCLUSION IN PRIMATES (AFTER COLYER)

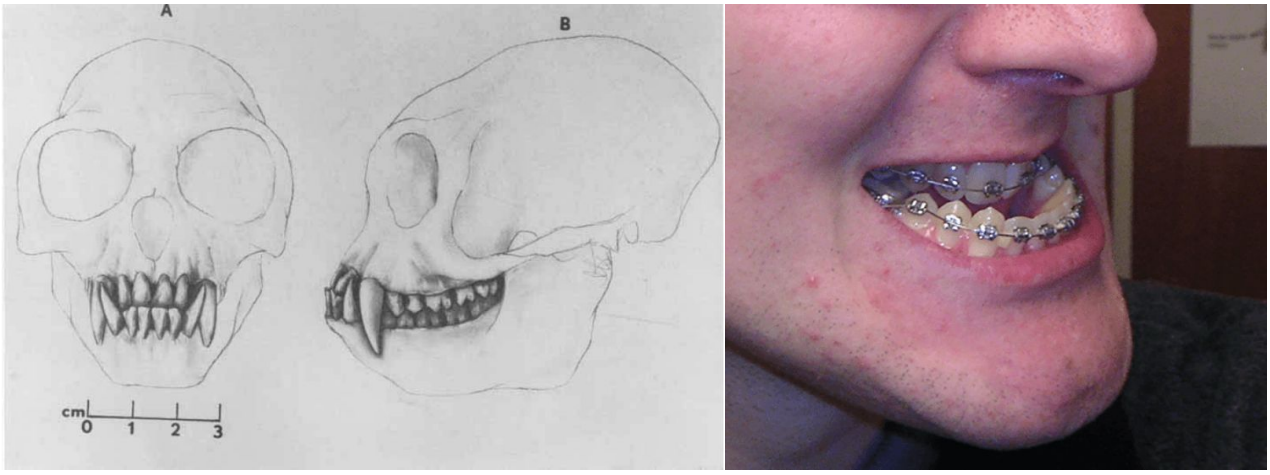
Super-family	Genus, etc.	No. of speci-mens	Per-centage varying	Ditto less pm	Cl. III
Apes	Gorilla	689	31·6	25	2·7
	Pan	465	22	17	4·5
	Pongo	255	25	21·6	1·1
O.W. Monkeys	Colobinae	2319	40·6	31·3	24·1
	Cercopithecinae	2725	30·3	18·1	0·3
N.W. Monkeys	Cebidae	2122	17·7	N.A.	11·7
	Hapalidae	211	9·5	N.A.	Nil
Prosimii		650	12	N.A.	N.A.

When this data is broken down further, we find that O.W (old world) monkeys have a higher malocclusion rate than most other primates. However, Mills notes that "many of the irregularities were confined to very slight rotations of the premolars, so slight as to be insignificant. The third column shows the percentage of irregularity in these two groups when such cases were excluded."

Mills goes on to say that "They are usually mild, and affect the occlusion but little. They fall into Angle's class I (where the posterior teeth and specifically first molars are in normal antero-posterior relation), and similar conditions are seen in man, where the condition is often more severe."

Regarding Class II malocclusion, in which the upper jaw overlaps the lower jaw, there was not a single identifiable case of this occurring. This is fascinating, the prevalence of this form of malocclusion can occur at a rate of up to 40% (Bilgic, Gelgor & Celebi 2015).

The final column gives the percentage of cases in which the lower incisors occlude in front of the uppers. This is known as a Class III malocclusion, or an underbite. While the rate of 24.7% in Colobinae may seem high, research indicates that it may in fact be an evolutionary response to their particular diet high in leaves, for efficient mastication. "The results suggest that a combination of mechanical pressures and idet may explain the underbite characteristic and that it is an adaptive trait to these dietary pressures" (Knowles & Sirianni, 2014). Unfortunately, the same cannot be said for Class III malocclusions in humans, which is considered to be maladaptive, and can seriously interfere with eating food.



Here is a side by side comparison of a "typical deep underbite" in a P. melalophos male of the Colobinae subfamily (Zingeser 1970) compared to a substantial underbite in a human. Clearly there is a difference in severity and the effect on mastication and overall function of these two images.

TABLE III

COMPARATIVE INCIDENCE OF MALOCCLUSION IN WILD AND CAPTIVE PRIMATES (AFTER COLYER)

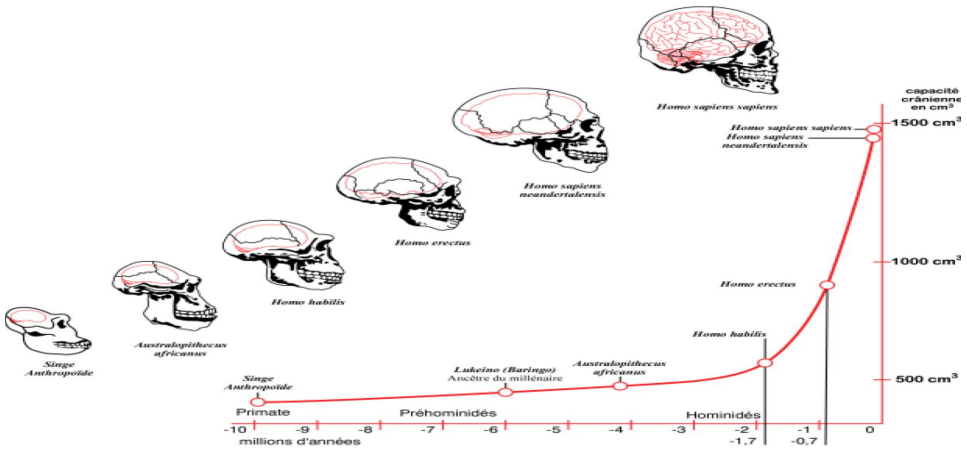
Super-family	Genus	Wild State No. of speci-mens	Wild State Per-centage varying	Captive State No. of speci-mens	Captive State Per-centage varying
Apes	*Pan*	367	23·4	22	45·6
	Hylobates	248	21·0	29	31·0
O.W. Monkeys	*Macaca*	398	30·7	305	38·7
	Cercopithecus	1095	27·0	338	25·4
	Erythrocebus	35	25·7	45	44·4
	Papio	221	29·4	153	45·1
N.W. Monkeys	*Cebus*	493	19·7	98	30·6
Prosimii		602	15·9	85	21·2

Colyer's research also found that captive state specimens often had far greater levels of malocclusion than their wild state counterparts. This gives an indication that something environmental may be at play. If wild primates have lower rates of malocclusion, would we expect wild humans to show the same? Let's delve into that.

According to anthropology professor, Peter Lucas, author of 'Dental Functional Morphology', "Virtually any mammalian jaw in the wild that you look at will be a perfect occlusion, a very nice Hollywood-style dentition."

Evolving to Eat Mush

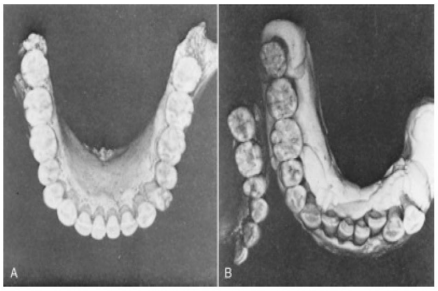
http://news.nationalgeographic.com/news/2005/02/0218_050218_human_diet_2.html



If this is a genetic issue, what kind of selection process may be encouraging the development of malocclusion? One idea is that as our brain grew, our jaws shrunk, but I don't see why that has to be competitive in any way. Plenty of animals have far bigger brains than ours, and don't have these issues. The idea presented in this same article is that, perhaps due to the softness of cooked foods, our jaws have gradually evolved to become smaller, as we don't require jaws as large and strong to mechanically process our cooked, soft diets. Let's put this idea to the test.

According to the general scientific consensus, we've been anatomically human since over 200,00 years ago. Perhaps we can observe the occlusion of our early ancestors to learn more. What do the teeth of these early humans tell us?

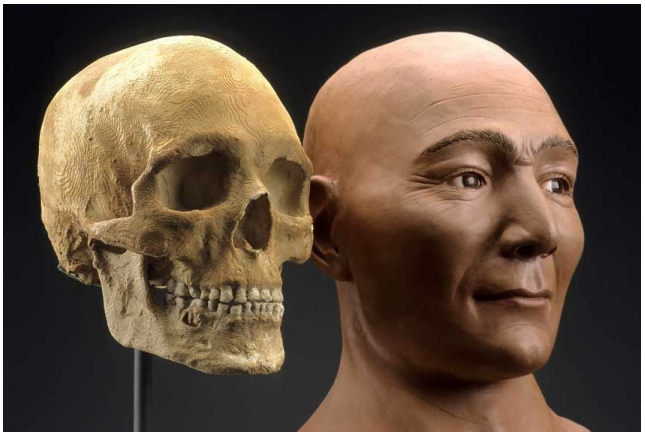
Let's keep in mind that even small observable changes can require hundreds of thousands of years of evolution to occur. Given this, we would therefore expect malocclusion to have existed at a similar percentage for Homo sapiens, hundreds of thousands of years ago. Except, the evidence paints a different picture.



(From Wolpoff WH. Paleoanthropology. New York: Alfred A Knopf; 1998.)

100,000 year old specimens from the Krapina cave in Yugoslavia. Skeletal remains from approximately 80 individuals present "near-perfect alignment or minimal crowding was the usual finding in this group."**Contemporary Orthodontics 4th ED**

Notice the broad, U-shaped dental arches and perfect occlusion in figure A. Figure B had the biggest teeth in the group, yet only experienced very minor crowding. Fully functional wisdoms in every specimen. Keep in mind these individuals have room for their wisdom teeth as well, something that is relatively rare in modern peoples.



Here we see a 10,00 year old native American male skull. Notice the robust, horizontal growth of the skull and broad features, as well as the healthy occlusion of all teeth, including the wisdom teeth.

https://www.cdapress.com/archive/article-7bcae138-1a25-11e6-8843-d3a01c727354.html
https://www.ancient-origins.net/news-history-archaeology/spirit-cave-mummy-0010987

According to professor of Anthropology, Ron Pinhasi, after studying almost 300 skulls from Anatolia to Europe (28,000 to 6,000 years ago), "Our findings show that the hunter gatherer populations have an almost "perfect harmony" between their lower jaws and teeth," he explains. "But this harmony begins to fade when you examine the lower jaws and teeth of the earliest farmers." They report the jaw “shrinking.”

Malocclusion and dental crowding arose 12,000 years ago with earliest farmers
http://www.ucd.ie/news/2015/02FEB15/050215-Malocclusion-and-dental-crowding-arose-12000-years-ago-with-earliest-farmers-study-shows.html

The hunter gatherer mandible on the left, just as all the others we've seen, is robust, horizontally grown, wide, and can fit all teeth, including the wisdom teeth. In fact, there is even space behind the wisdom teeth. In contrast, while the agrarian mandible has wisdom teeth in position, there is significant incisor crowding. Also, notice the V-shaped dental arch, as opposed to the U-shaped ones characteristic of hunter gatherers.

Lower jaw and teeth of Mesolithic hunter-gatherer (Credit: Olivia Cheronet)

Lower jaw and teeth of Early Neolithic farmer (Credit: Olivia Cheronet)

Prominent researcher Robert Corruccini and Elsa Pacciani assessed the occlusion and facial development of more recent Etruscan skulls from the 8-9th Century B.C.

"Specimens dating back to the VIII Century B.C. indicate Etruscans may have been the first people to employ orthodontic bands to improve tooth alignment. A survey of dental occlusion in Etruscan cranial remains, however, shows very good typical occlusion and almost no crowding. Thus, these people do not represent the earliest development of epidemiologically high prevalence of malocclusion, a feature instead reserved for the later industrial world." Below, this skull from the National Museum of Archaeology displays what the researchers refer to as displaying "ideal classic dental occlusion."

Corrucini & Pacciani, 1989. Orthodontistry and dental occlusion in Etruscans.
https://sci-hub.tw/10.1043/0003-3219(1989)059%3C0061:OADOIE%3E2.0.CO;2

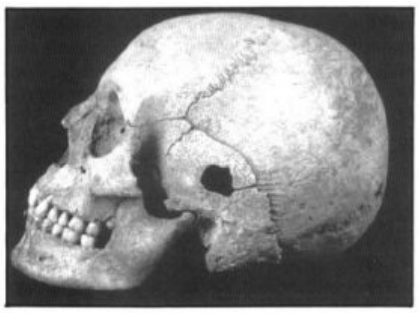


Figure 1


Figure 2

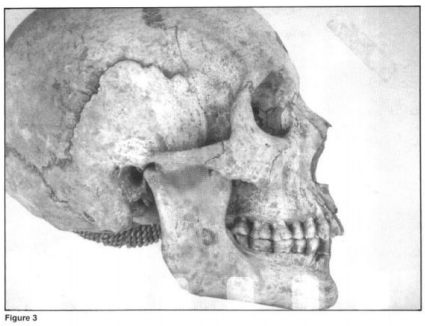


Figure 3

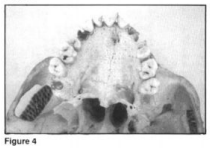


Figure 4

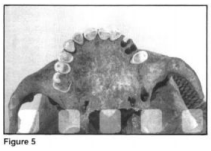


Figure 5

"Figure 3. A most complete and typical Etruscan specimen...slight degree of vertical incisor overbite, and near-perfect dental alignment throughout lower and upper arches. Although incisor relations were generally difficult to determine for most Etruscan specimens due to postmortem tooth loss and poor preparation and storage, the other occlusal traits are, like this, typically of very low variance from the figured ideal."

"Etruscans resemble hunter-gatherer (and other non-acculturated) people much more than the frequently maloccluded modern western people, confirming the very recent epidemiological proliferation of malocclusion.

"Some of the low scores for Etruscans must result from inability to score the relations among missing teeth (although the alveoli could nevertheless be observed), and more reduction in the apparent level of occlusal variability would occur if maloccluded adults were more likely to become edentulous and hence be unscorable. Nevertheless, these nonrandom factors must be fairly minor influences on the results; it is reasonable to infer that the Etruscan samples fall into the lower range of occlusal

variations shown by human foragers and primitive agriculturalists, as opposed to modern and industrialized samples."

"Aside from suggested genetic mechanisms, various dietary factors are major potential determinants. Among these, the interproximal attrition brought about by dietary grift may increase archspace in aboriginals. We favor an old anthropological idea that dietary consistency and toughness promote alveolar remodelling and proper permanent tooth eruption, bringing about ideal adult occlusion; when nonresistant processed foods become ubiquitous after industrialisation, malocclusion shows a rapid rise. Etruscan diet, even for the nobility, was not intensively refined. Meat was derived mostly from domestic animals...Cereals, wheat and grains for a relatively coarse bread were the staple foods."

All 50 of these Etruscan skulls were compared with worldwide samplings of aboriginal / forager, acculturating / agricultural, and industrialised / modern populations in regards to crossbite and buccal segment relation traits, with the results viewable below, indicating a link with malocclusion and modernization.

Table 1

Mean values (with 95 percent confidence intervals based on the standard error) for rotation/displacement score, and standard deviations (with 95 percent intervals) for crossbite and buccal segment relation traits, for 50 Etruscan specimens compared with worldwide samplings of aboriginal/forager, acculturating/agricultural, and industrialized/modern populations. The mean is the proper unit of comparison for the R/D count while the variance (deviation from an ideal mean of zero) is the basis for comparison of the molar/premolar relation traits.

Grouping	Crossbite		BSR		R/D	
	S.D.	Limits	S.D.	Limits	Mean	Limits
Aboriginal	.186	.170-.205	.246	.225-.271	1.52	1.38-1.66
Acculturating	.214	.202-.227	.315	.298-.334	3.13	2.97-3.29
Industrialized	.338	.323-.355	.512	.489-.537	4.39	4.20-4.58
Etruscans	.094	.076-.121	.080	.065-.103	0.27	0.10-0.44

It seems that the shift from hunter gatherer lifestyles to agrarian ones were associated with an increased rate of malocclusion. Would that rate continue to increase, the more modernized a society became?

Scandinavian researchers tested this idea, and observed 146 medieval 16th century skulls, comparing them with 99 modern children.

“Only 36% of the medieval group showed objective assessed needs for orthodontic treatment, compared with 65% in the present-day sample.

“7% of the medieval skulls had severe malocclusion, compared to 21% of the modern sample."

"Conclusions: This study indicates a significant increase in both the prevalence and the severity of malocclusions during the last 400 to 700 years in Oslo, Norway...Females had both a higher prevalence of malocclusions and more severe malocclusions than did males in the past."

" 36% in the middle ages, while still lower than the modern norm by a substantial margin, is certainly higher than the research available from hunter gatherer skulls. Furthermore, given that these skulls were found merely hundreds of years ago, it seems incredibly unlikely that this near doubling of malocclusion has a genetic basis.

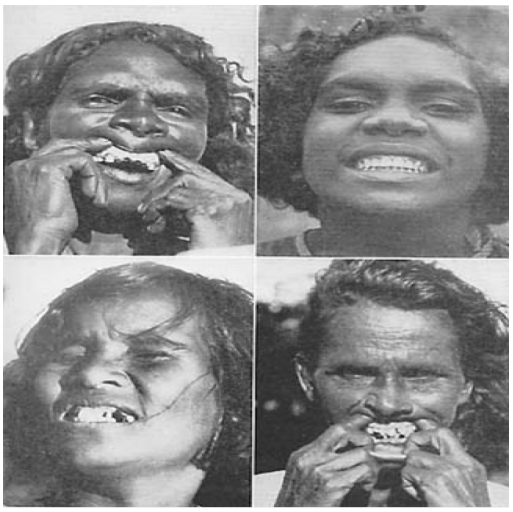
Are malocclusions more prevalent and severe now? A comparative study of medieval skulls from Norway. http://www.ncbi.nlm.nih.gov/pubmed/17561048

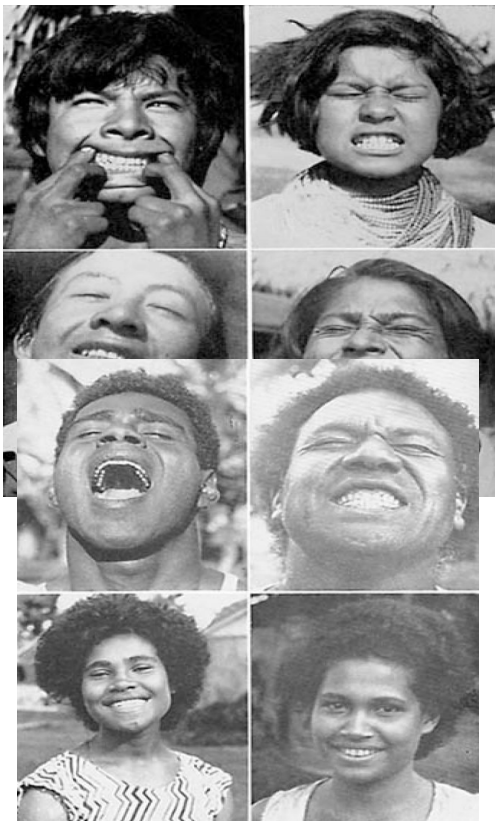
What is the pattern we are seeing? Paleolithic societies had extremely low malocclusion rates, very mild, and likely due to disease or trauma. As we move to a more ‘civilised’ medieval diet, malocclusion levels bump up, and when we become fully civilised, malocclusion levels skyrocket, as well as their severity. Impacted wisdom teeth and the need for extractions are modern, and have never been seen in a single recent paleolithic skull, who always had space behind the wisdom teeth, which were always fully functional.

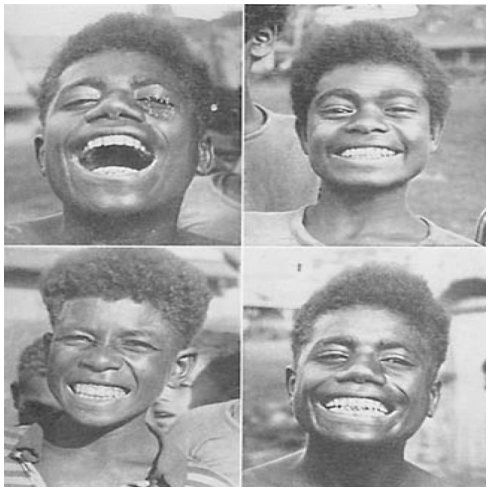
Nutrition and Physical Degeneration

Weston A. Price, a dentist in the early 1900s noticed that in his younger patients, the prevalence and severity of malocclusion was much greater than their parents, which struck him as alarming. Let’s keep in mind that during the 1900s, flour, sugar and canned, refined foods started to become dietary staples in young people, not so much their parents. Let’s keep in mind that this was when

globalisation and ‘racial mixing’ became more common. Could nutrition have something to do with rising malocclusion? What about isolated pockets around the world, people untouched by civilised diets? How did they fare against their modern counterparts?

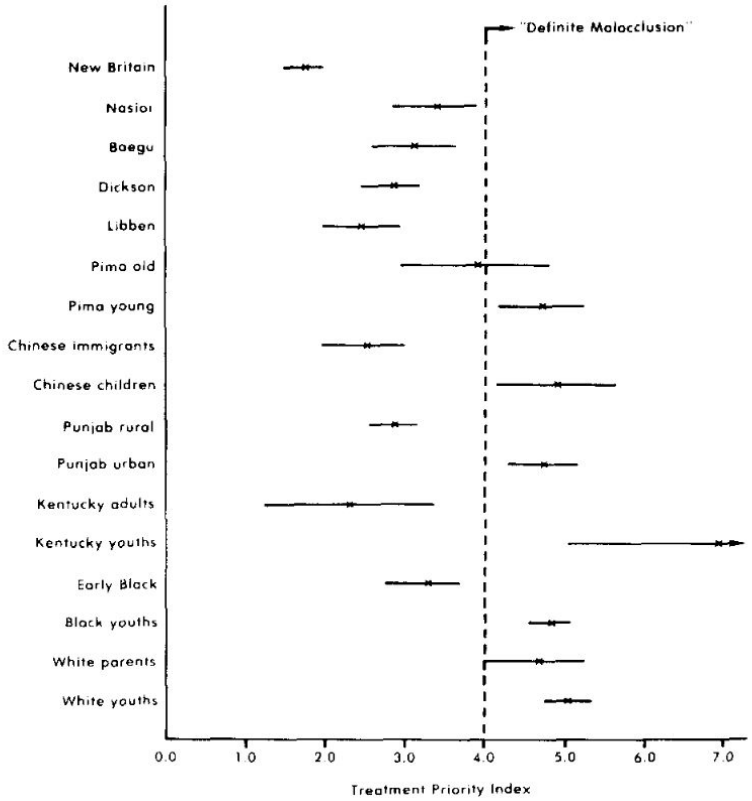






This is, as distinguished professor and anthropologist Robert Corruccini puts it, “a disease of civilisation.”

An epidemiological transition in dental occlusion in world populations.
http://www.sciencedirect.com/science/article/pii/S0002941684900356



No research that any nutrient could promote wide facial structure. People with malocclusion typically don’t have teeth that are rotting out of their skull, so they clearly have the minerals required to make their jaw, bones and teeth, but what could cause them to not grow properly? Suggested vitamin culprits are calcium, vitamin A and vitamin D, which are non-problems in Australia, with high dairy consumption as well as one of the highest rates of skin cancer (lots of vitamin D) yet malocclusion levels are still very severe.

“While in the isolated groups not a single case of a typical mouth breather was found, many were seen among the children of the lower-plains group.” Could mouth breathing have something to do with this?

Mouth breathing was developed in the experiment by obstruction of the nasal passages with nose plugs. All experimental animals acquired a facial appearance and dental occlusion different from those of the controls. The dentition developed normally in all controls, as is typical of primates and all other organisms in existence. The experimental animals were another story. Every single one developed malocclusion.

Fig. 4. The animal lowered the mandible and protruded the tongue. Eighteen months of mouth breathing produced a notch in the upper lip **(A)** and a severe open-bite **(B).**

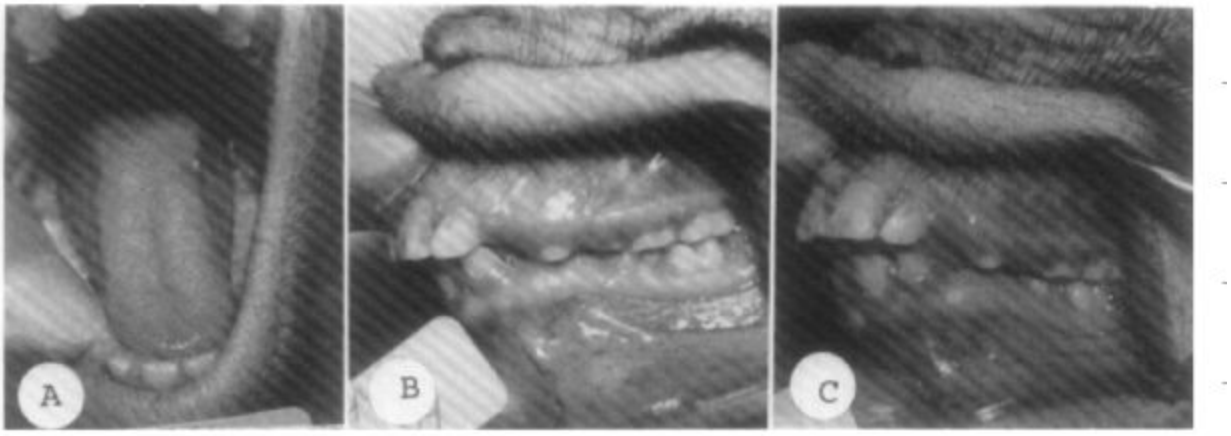


Fig. 6. This animal developed a flattening of the upper surface and at the edges of the tongue, providing three channels for airflow **(A).** An incisor overjet, a dual bite, and a mild Class II malocclusion characterized the dentition (**B** and **C**).

The other animals which positioned the mandible downward and forward, with the tongue below the maxillary incisors developed a Class III malocclusion.

"The primates in these experiments developed an oral airway in response to nasal obstruction. The response was not uniform among the animals. However, some traits were common: increased facial height, steeper mandibular plane and larger gonial angle." No change in the diet or nutrient density of the diet, but severely different occlusion, and not only that, but a major difference in facial structure.

Primate experiments on oral respiration.
http://www.sciencedirect.com.ezproxy.uws.edu.au/science/article/pii/0002941681903791

Another study conducted by Britta S. Tomer found the same results in 16 monkeys. The eight of the 16 with induced oral respiration had a lowering of the chin, a steeper mandibular plane, and an increase in the gonial angle compared with the the control animals. The same malocclusion results were found as well.

Primate experiments on mandibular growth direction.
http://www.ncbi.nlm.nih.gov/pubmed/6961782

But they're monkeys, what about humans?

The effect of mouth breathing on dentofacial morphology of growing child.
http://medind.nic.in/jao/t12/i1/jaot12i1p27.htm

“Changed mode of respiration was associated with increased facial height, mandibular plane angle and gonial angle...longer faces.”

Mouth breathing in allergic children: Its relationship to dentofacial development.
https://www.ncbi.nlm.nih.gov/pubmed/6573147

"The upper anterior facial height and the total anterior facial height were significantly larger in the mouth breathers. Angular relationships of the sella-nasion, palatal, and occlusal planes to the mandibular plane were greater in the mouth breathers, and their gonial angles were larger. The mouth breathers’ maxillae and mandibles were more retrognathic. Palatal height was higher, and overjet was greater in the mouth breathers. Maxillary intermolar width was narrower in the mouth breathers and was associated with a higher prevalence of posterior cross-bite. Over all, mouth breathers had longer faces with narrower maxillae and retrognathic jaws. This supports previous claims that nasal airway obstruction is associated with aberrant facial growth."

Breathing mode influence in craniofacial development. https://www.ncbi.nlm.nih.gov/pubmed/16446911

"It was observed that the measurements for the inclination of the mandibular plane (SN.GoGn) in mouth breathing children were statistically higher than those in nasal breathing children. The posterior facial height was statistically smaller than the anterior one in mouth breathing children (PFH-AFH ratio). Thus, the upper anterior facial height was statistically smaller than the lower facial height (UFH-LFH ratio)...We concluded that mouth breathing children tend to have higher mandibular inclination and more vertical growth. These findings support the influence of the breathing mode in craniofacial development"

Skeletal and occlusal characteristics in mouth-breathing pre-school children.
https://www.ncbi.nlm.nih.gov/pubmed/15366619

The skeletal pattern measurements...indicated a tendency to mouth-breathing children presenting a dolichofacial pattern. According to occlusal characteristics, only the intermolar distance showed a significant correlation with a narrow maxillary arch in mouth-breathing subjects. Based on the results of this study, mouth-breathing can influence craniofacial and occlusal development early in childhood.

The effect of mouth breathing versus nasal breathing on dentofacial and craniofacial development in orthodontic patients. https://www.ncbi.nlm.nih.gov/pubmed/20824738

"Mouth breathers demonstrated considerable backward and downward rotation of the mandible, increased overjet, increase in the mandible plane angle, a higher palatal plane, and narrowing of both upper and lower arches at the level of canines and first molars compared to the nasal breathers group.

The prevalence of a posterior cross bite was significantly more frequent in the mouth breathers group (49%) than nose breathers (26%), (P = .006). Abnormal lip-to-tongue anterior oral seal was significantly more frequent in the mouth breathers group (56%) than in the nose breathers group (30%) (P = .05)...Naso-respiratory obstruction with mouth breathing during critical growth periods in children has a higher tendency for clockwise rotation of the growing mandible, with a disproportionate increase in anterior lower vertical face height and decreased posterior facial height."

Effect of mouth breathing on dental occlusion.
https://www.angle.org/doi/pdf/10.1043/0003-3219(1973)043%3C0201:EOMBOD%3E2.0.CO%3B2

"From the present study it can be concluded that the effect of mouth breathing was confined to the changes in maxillary arch dimensions. There was contraction of maxillary arch and increase in maxillary arch length. An increased overjet and deep overbite were present in these cases. The palate appeared high, not because its height was actually increased, but due to contraction of the maxillary arch. A higher percentage of Class II, division 1 malocclusion was seen in mouth breathers."

Facial characteristics of children who breathe through the mouth.
https://www.ncbi.nlm.nih.gov/pubmed/6718117

"Thirty children with allergy, aged 6 to 12 years, who had moderate-to-severe nasal mucosal edema on physical examination and who appeared to breathe predominantly through the mouth and 15 children without allergy who had normal findings from nasal examination and who appeared to breathe predominantly through the nose were evaluated...In comparison with children who breathed through the nose, children who breathed through the mouth had longer faces with narrower maxillae and retruded jaws. This supports the hypothesis that children with nasal obstruction and who appear to breathe through the mouth have distinctive facial characteristics."

Prevalence and factors related to mouth breathing in school children at the Santo Amaro project-Recife 2005
http://www.scielo.br/scielo.php?script=sci_arttext&pid=S2179-64912011000400005&lng=en&nrm=iso&tlng=en

"mouth breathing prevalence was of 53.3%. There was no significant difference between gender, age and type of breathing. Facial alterations were: incomplete lip closure (58.8% X 5,7%), fallen eyes (40.0% X 1.4%), High palate (38.8% X 2.9%), Anterior open bite (60.0% Versus 30.0%), Hypotonic lips (3.8% X 0.0%), Circles under the eyes (97.5% Versus 77.1%)...There were significant differences between physical traits and breathing pattern."

Influence of Mouth Breathing on the Dentofacial Growth of Children: A Cephalometric Study
http://europepmc.org/articles/pmc4295456

"All subjects with mouth-breathing habit exhibited a significant increase in lower incisor proclination, lip incompetency and convex facial profile. The presence of adenoids accentuated the facial convexity and mentolabial sulcus depth."

Effect of Naso-respiratory Obstruction with Mouth Breathing on Dentofacial and Craniofacial Development https://www.nepjol.info/index.php/OJN/article/view/21343

"The mouth breathers had backward and downward rotation of mandible with increased overjet, increased mandibular plane angle, higher palatal plane, and constriction of upper and lower arches at the level of cuspids and first molars when compared with nasal breathers group. The prevalence of posterior cross bite was observed greater in mouth breathers group (40%) than the nose breathers (20%) (p =0.006). Abnormal lip-to-tongue anterior oral seal was seen more in the mouth breathers group (55%) than in nose breathers group (25%) (p = 0.05).

Conclusion: Naso-respiratory obstruction with mouth breathing during growth periods in children has a greater tendency for clockwise rotation of growing mandible, with an irregular increase in anterior lower vertical face height and decreased posterior facial height."

Dental consequences of mouth breathing in the pediatric age group
http://www.ijohsjournal.org/article.asp?issn=2231-6027;year=2013;volume=3;issue=2;spage=79;epage=83;aulast=Malhotra

"Mouth breathers demonstrated considerable increase in palatal height and increased overjet, and statistically significant narrowing of the upper arch at the level of the molar.

Conclusion: Changed mode of respiration during critical growth periods in children has a higher tendency for increased palatal height and overjet, reduced overbite and maxillary intermolar width."

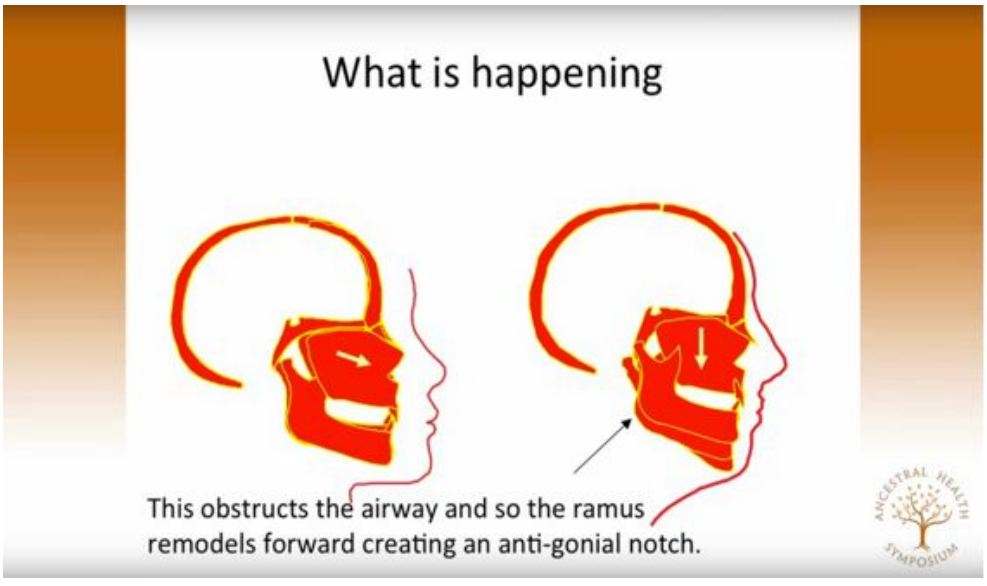
Conflicting Evidence

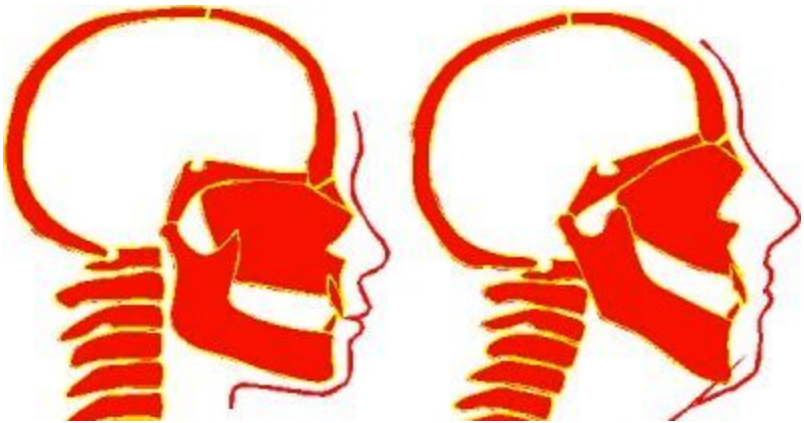
A study on the relationship between mouth breathing and facial morphological pattern
https://www.sciencedirect.com/science/article/pii/S1808869415301014

"by means of anthropometric indexes we classified facial types and associated them with the person's breathing type, Hypereuriprosopic (Total=0; oral breathers 0%; nasal breathers 0%; Euriprosopic (Total=14; oral breathers 2.52%, nasal breathers 9.24%;Mesoprosope (Total=20; oral breathers 19.32%; nasal breathers 21.01%, Leptoprosopic (Total=37; oral breathers 14.29%; nasal breathers 16.81%; Hyperleptoprosopic (Total =48; oral breathers 5.89% nasal breathers 10.92%). The mesoprosopic facial type was found in 48 teenagers (40.33%) of whom 25 (21.01%) were oral

breathers and 23 (19.32%) were nasal breathers. Conclusion: it was not possible to prove the existence of an association between oral breathing and facial type."

Bone responds to force. The direction in which it is directed is the direction in which it will grow. If so, what could be the force pushing downwards on the skull, causing it to grow longer? An invisible force, perhaps? Why not gravity?

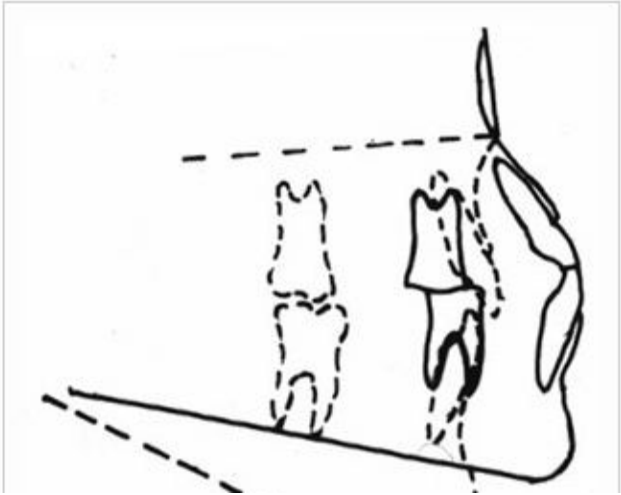




The tongue essentially acts as a counter-balance to the force of gravity, which would otherwise push the maxilla downwards and back, which would in turn push the mandible down and back. When the tongue is pressed against the palette, upwards and forwards, the face grows forwards and has room for all thirty two teeth, as well as perfect occlusion.

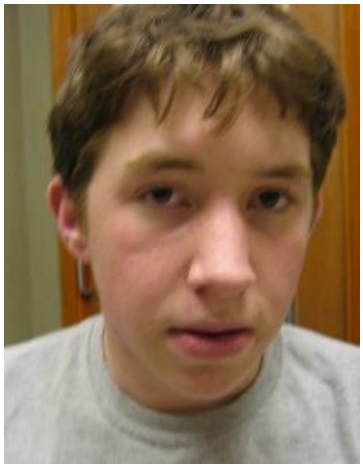
Who is more attractive? And why? Who has the healthier airway?

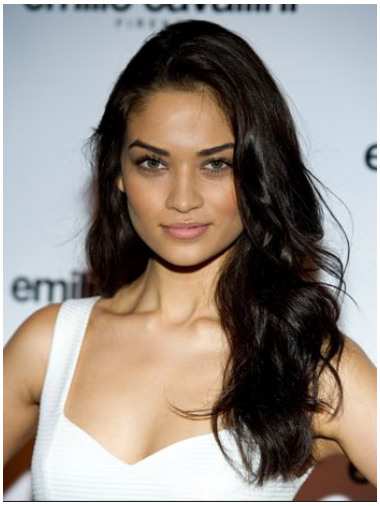
A cephalometric norm vs a paleolithic norm. All paleolithic skulls grew horizontally with a slight downward tilt due to the guiding force of the tongue and **plenty** of room for all 32 teeth, including the wisdoms. This horizontal growth is incredibly rare today, only seen in actors and models, but it shouldn't be.



Every child has the potential to have horizontal facial structure.

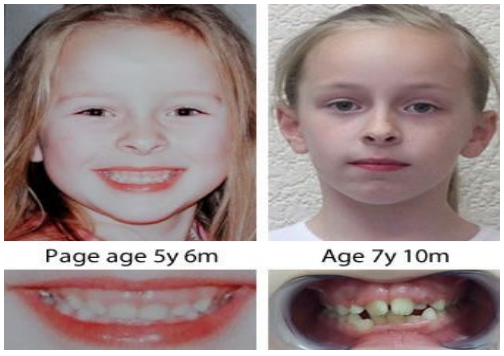
Craniofacial dystrophy: A possible syndrome?
http://www.nature.com/bdj/journal/v216/n10/full/sj.bdj.2014.401.html





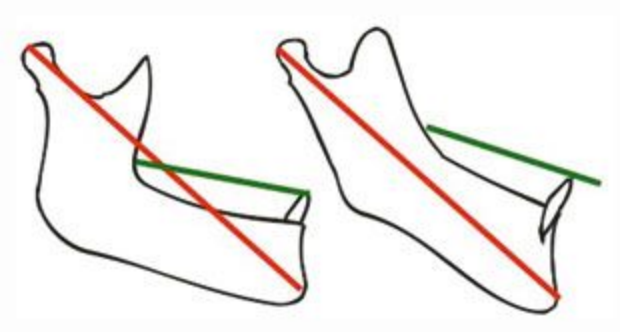
If you're an orthodontist, take a close look at those two sets of photos. Do your patients with serious malocclusions often have an obviously open mouth, or strain to keep their lips together? Do they have darkness under their eyes, signifying allergies? What about your most attractive patients? Do they tend to have the least problems, and much better occluded teeth? Not only is this condition affecting our children's facial development, sleep apnea has very serious effects, especially on growing brains.

We all start with horizontal, good looking faces. Any 3-5 year old has a horizontal, wide face. This is because we are genetically designed to have forward growth, it's how we develop in the womb, but mouth breathing and improper tongue posture can change all this. We all have that one friend…whom we notice has gotten homelier as they went through puberty, or it could be you, it could be your child, as you notice something very bizarre happening as you go through the family photos. Notice the girl on the left, you can already see how a lack of proper tongue posture has pushed her maxilla down, exposing her gums. Notice the change in facial shape as she ages, which will only worsen. If you have any young teenager patient with serious malocclusion, look at the before and afters of their faces after braces. Further lengthening of the face as caused by the drooping down of the maxilla and the mandible is the norm.



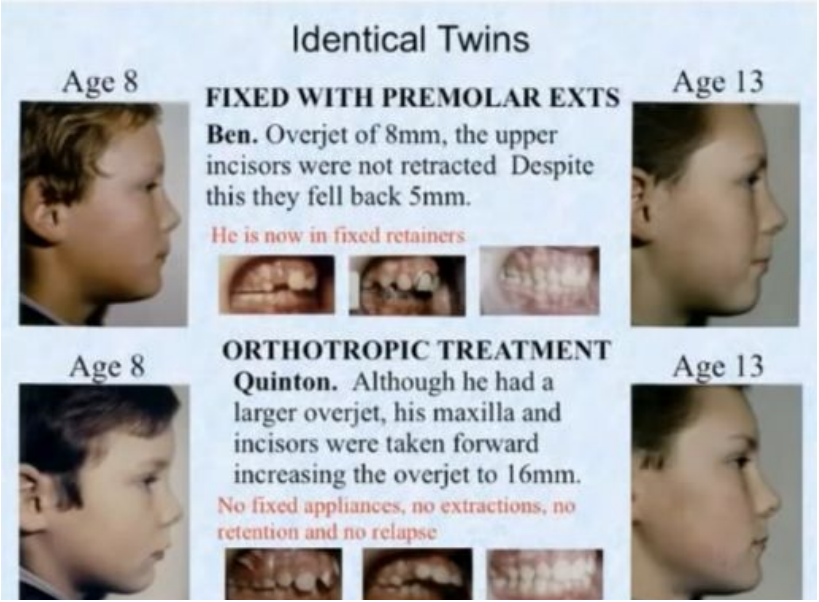
This child started off with good growth, but in his young years he adopted a gerbil which he was allergic to, and as a result, his face has lengthened considerably.
Horizontal growth is our, as well as all other creature's genetic design. I would go so far as to say not a single wild skull of any species has vertical growth. Are we just unlucky? Or is something else at play?
Notice how all of these animal specimens have square shaped gonial angles. If we look at the skull of a fetus, we see that same pattern. But something appears to change as we age..

How does this relate to malocclusion? These two jaws are identical in sheer length, but one is growing horizontally, while the other grows vertically. This matches up directly with where we see orthodontic problems today. Impacted wisdom teeth and crowded incisors. Our skulls are not smaller, they are longer!



Craniofacial dystrophy: A possible syndrome?
http://www.nature.com/bdj/journal/v216/n10/full/sj.bdj.2014.401.html

So if the logic holds and lowered tongue posture can lead to a vertically growing face, what can happen if we see anterior rotation, or the forwards / upwards force that the tongue provides? What would we see if we are to correct tongue posture? This is what orthotropics aims to do. It refers to "guiding growth" and often uses appliances designed to help correct tongue posture and swallowing pattern.



Work on conclusion - Based on all of the available evidence, it appears clear that malocclusion and craniofacial dystrophy, which is the norm in the developed world, is not primarily genetic, but a result of key environmental factors, such as masseter disuse, and incorrect tongue form. Should we treat these factors, we may be able to essentially cure malocclusion within a single generation.

All information here is free to share / use at anyone's leisure. Feel free to leave a comment if you would like to say something.

Some results achieved with correct tongue posture and function.

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